

WHAT IS CLAIMED IS:

- 1 1. A color filter comprising:
2 a transparent substrate layer;
3 a color filtering layer comprising a plurality of substantially coplanar color
4 filtering segments; and
5 a wavelength converting layer, said wavelength converting layer comprising a
6 single kind material having a property of producing emergent light having a first range of
7 wavelengths greater than a predetermined wavelength value in response to receiving a portion
8 of incident light comprising wavelengths less than said predetermined wavelength value,
9 said wavelength converting layer being at least substantially co-extensive with
10 said color filtering layer,
11 said wavelength converting layer being a single layer of material,
12 said transparent substrate layer, said color filtering layer, and said wavelength
13 converting layer arranged to form a laminated structure.
- 1 2. The color filter of claim 1 wherein said single kind of material is
2 selected from the group consisting of: 7-dimethylamino-4-methylcoumarin, 7-hydroxy-4-
3 methylcoumarin, perylene, 1,4-bis(4-methyl-5-phenylxazol-2-yl)benzene, and 7-
4 dimethylamino-4-methyl-2-hydroxyquinoline.
- 1 3. The color filter of claim 1 wherein said color filtering segments of said
2 color filtering layer are disposed between said transparent substrate layer and said wavelength
3 converting layer, said wavelength converting layer having a substantially flat surface portion
4 co-extensive with said color filtering layer.
- 1 4. The color filter of claim 1 further including a flattening layer, said
2 wavelength converting layer being disposed between said transparent substrate layer and said
3 color filtering layer, said flattening layer being disposed at least on said color filtering
4 segments.
- 1 5. The color filter of claim 1 further including a flattening layer and an
2 opaque layer, said opaque layer substantially non-transmissive of light, said color filtering
3 segments disposed in and substantially coplanar with said opaque layer, said wavelength
4 converting layer being disposed between said transparent substrate layer and said color
5 filtering layer.

1 6. The color filter of claim 1 further including an opaque layer, said
2 opaque layer substantially non-transmissive of light, said color filtering segments disposed in
3 and substantially coplanar with said opaque layer, said color filtering segments being
4 disposed between said transparent substrate layer and said wavelength converting layer, said
5 wavelength converting layer having a substantially flat surface portion co-extensive with said
6 color filtering layer.

1 7. The color filter of claim 1 wherein said predetermined wavelength
2 value is about 420 nm.

1 8. The color filter of claim 1 as incorporated in a liquid crystal display
2 device, said liquid crystal display device comprising a liquid crystal display unit as a first
3 layer of said liquid crystal display device and said color filter as a second layer of said liquid
4 crystal display device disposed on said first layer of said liquid crystal display device.

1 9. A color filter comprising a light-transmissive substrate, a color filtering
2 layer disposed on said light-transmissive substrate, and a wavelength converting layer
3 disposed on said color filtering layer and substantially co-extensive with said color filtering
4 layer, said color filtering layer comprising a plurality of substantially coplanar color filtering
5 segments, said wavelength converting layer effective for receiving a portion of incident light
6 having wavelengths shorter than a predetermined wavelength and in response thereto
7 producing emergent light having a first range of wavelengths longer than said predetermined
8 wavelength.

1 10. A color filter comprising a light transmissive substrate, a wavelength
2 converting layer disposed on and co-extensive with said light transmissive substrate, a
3 plurality of substantially coplanar color filtering segments disposed on said wavelength
4 converting layer, and a flattening layer disposed over portions of said wavelength converting
5 layer and on said color filter segments, said wavelength converting layer effective for
6 receiving a portion of incident light having wavelengths shorter than a predetermined
7 wavelength and in response thereto producing emergent light having a first range of
8 wavelengths longer than said predetermined wavelength.

1 11. A color filter comprising a light transmissive substrate, a wavelength
2 converting layer disposed on and co-extensive with said light transmissive substrate, an

3 opaque layer of material that is substantially non-transmissive of light and is disposed on said
4 wavelength converting layer and having a plurality of openings therethrough to said
5 wavelength converting layer, a plurality of color filter segments disposed in said openings,
6 and a flattening layer disposed over portions of said wavelength converting layer and on said
7 color filter segments, said wavelength converting layer effective for receiving a portion of
8 incident light having wavelengths shorter than a predetermined wavelength and in response
9 thereto producing emergent light having a first range of wavelengths longer than said
10 predetermined wavelength.

1 12. A color filter comprising a light-transmissive substrate, a color filtering
2 layer disposed on said light-transmissive substrate, and a wavelength converting layer
3 disposed on said color filtering layer and substantially co-extensive with said color filtering
4 layer, said color filtering layer comprising a layer of material substantially opaque to light
5 having a plurality of openings therethrough to said wavelength converting layer, said color
6 filtering layer further comprising a plurality of color filter segments disposed in said
7 openings, said wavelength converting layer effective for receiving a portion of incident light
8 having wavelengths shorter than a predetermined wavelength and in response thereto
9 producing emergent light having a first range of wavelengths longer than said predetermined
10 wavelength.

1 13. In a liquid crystal display comprising in liquid crystal device layer and
2 a color filter disposed on said liquid crystal device layer, said color filter comprising:
3 a transparent substrate layer;
4 a color filtering layer comprising a plurality of substantially coplanar color
5 filtering segments; and

6 a wavelength converting layer, said wavelength converting layer comprising a
7 single kind of material having a property of producing emergent light having a first range
8 wavelengths greater than a predetermined wavelength value in response to receiving a first
9 portion of incident light having wavelengths less than said predetermined wavelength value,
10 said wavelength converting layer being at least substantially co-extensive with
11 said color filtering layer, said wavelength converting layer being a single layer of material,
12 said transparent substrate layer, said color filtering layer, and said wavelength
13 converting layer arranged to form a laminated structure.

1 14. The liquid crystal display of claim 13 wherein said single kind of
2 material is selected from the group consisting of: 7-dimethylamino-4-methylcoumarin, 7-hy-
3 droxy-4-methylcoumarin, perylene, 1,4-bis(4-methyl-5-phenylxazol-2-yl)benzene, and 7-
4 dimethylamino-4-methyl-2-hydroxyquinoline.

1 15. The liquid crystal display of claim 13 further including an opaque layer
2 of material that is substantially non-transmissive of light and is disposed between said
3 transparent substrate layer and said wavelength converting layer and having a plurality of
4 openings therethrough to said transparent substrate layer, said plurality of color filter
5 segments being disposed in said openings, said wavelength converting layer having a
6 substantially flat surface portion co-extensive with said color filtering layer.

1 16. The liquid crystal display of claim 13 further including a flattening
2 layer and an opaque layer, said opaque layer substantially non-transmissive of light, said
3 color filtering segments disposed in and substantially coplanar with said opaque layer, said
4 wavelength converting layer being disposed between said transparent substrate layer and said
5 color filtering layer, said flattening layer disposed over said color filtering segments of said
6 color filtering layer.

1 17. A color filter comprising:
2 a light transmissive layer having a major surface;
3 a color filtering layer comprising a plurality of substantially coplanar color
4 filtering segments;
5 a first wavelength converting layer comprising a plurality of substantially
6 coplanar first and second wavelength converting segments, said first wavelength converting
7 segments effective for producing first emergent light having a first range of wavelengths
8 greater than a first wavelength value in response to receiving a first portion of incident light
9 having wavelengths less than said first wavelength value, said second wavelength converting
10 segments effective for producing second emergent light having a second range of
11 wavelengths greater than a second wavelength value in response to receiving a second
12 portion of said incident light having wavelengths less than said second wavelength value; and
13 a second wavelength converting layer at least substantially co-extensive with
14 said color filtering layer, said second wavelength converting layer being a single layer of
15 material, said wavelength converting layer effective for producing third emergent light

16 having a third range of wavelengths greater than a third wavelength value in response to
17 receiving a third portion of said incident light having wavelengths less than said third
18 wavelength value,

19 each of said first and second wavelength converting segments substantially in
20 vertical alignment with one of said color filtering segments, some of said color filtering
21 segments not being in vertical alignment with any of said wavelength converting segments,
22 said light transmissive substrate layer, said color filtering layer, said first
23 wavelength converting layer, and said second wavelength converting layer arranged to form a
24 laminated structure.

1 18. The color filter of claim 17 wherein said color filtering segments are
2 disposed on said major surface of said light transmissive layer, some of said color filtering
3 segments being disposed between said major surface and one of said first and second
4 wavelength converting segments, said second wavelength converting layer being disposed
5 over said first and second wavelength converting segments and at least over some of said
6 color filtering segments, said second wavelength converting layer having a substantially flat
7 surface portion co-extensive with said color filtering layer.

1 19. The color filter of claim 17 further including a flattening layer, wherein
2 said second wavelength converting layer is disposed on said major surface of said light
3 transmissive layer, said first and second wavelength converting segments are disposed on
4 said second wavelength converting layer, said color filtering segments are disposed on said
5 first and second wavelength converting segments and on said second wavelength converting
6 layer, said flattening layer is disposed over said first and second wavelength converting
7 segments and on some of said color filtering segments.

1 20. The color filter of claim 17 wherein said first wavelength value is
2 about 550 nm, said second wavelength value is about 480 nm, and said third wavelength
3 value is about 420 nm.

1 21. A liquid crystal display having a color filter, said liquid crystal display
2 comprising:
3 a pair of glass substrates;
4 a liquid crystal layer disposed between said glass substrates;
5 a layer of transistor elements disposed between said glass substrates; and

6 a color filter layer disposed between said glass substrates comprising:
7 a transparent substrate layer;
8 a color filtering layer comprising a plurality of substantially coplanar
9 color filtering segments; and
10 a wavelength converting layer, said wavelength converting layer
11 comprising a single kind of material having a property of producing emergent light having a
12 first range wavelengths greater than a first wavelength value in response to receiving a first
13 portion of incident light having wavelengths less than said first wavelength value, said
14 wavelength converting layer being at least substantially co-extensive with said color filtering
15 layer, said wavelength converting layer being a single layer of material.
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